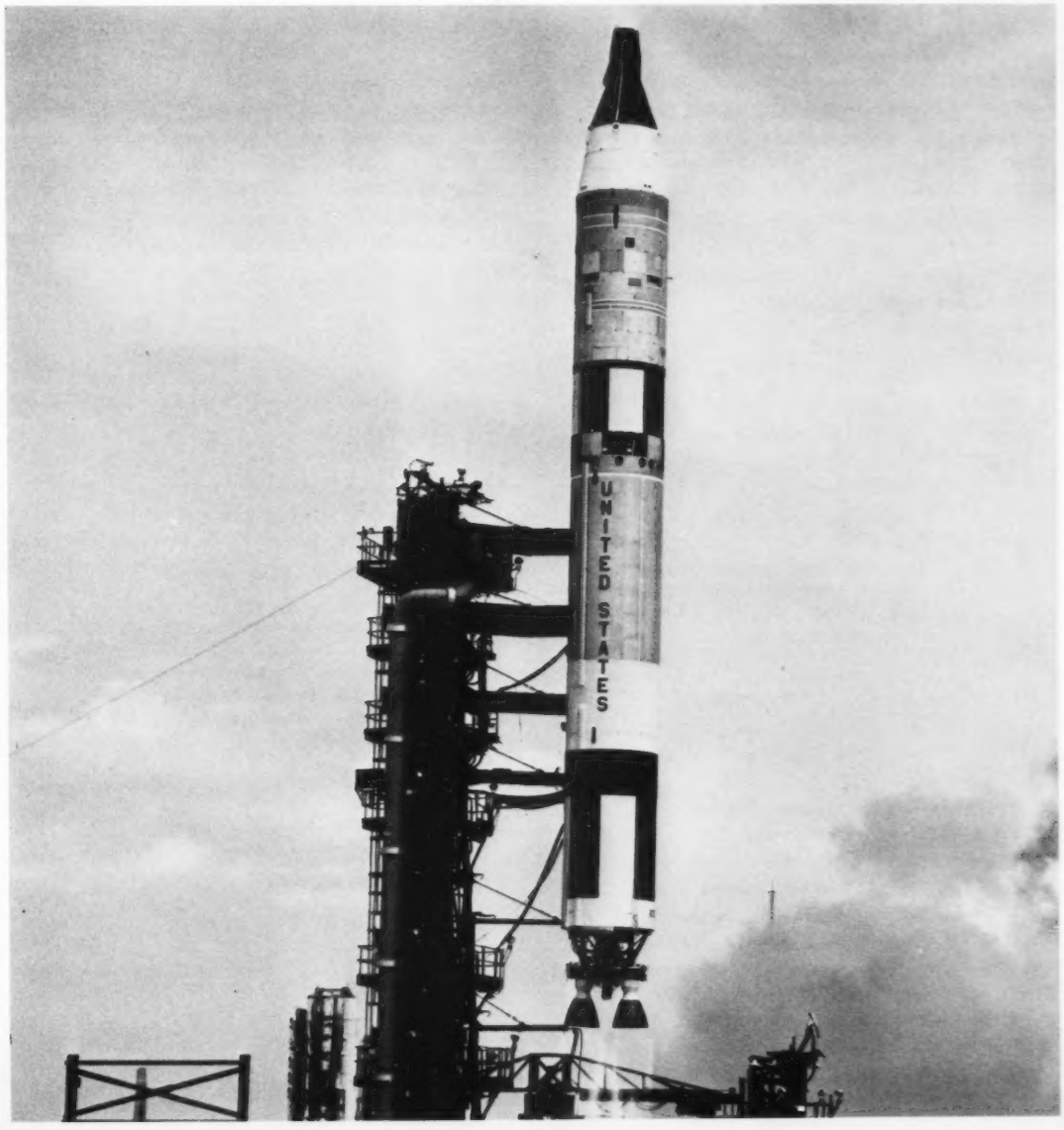
NASA Activities

National
Aeronautics and
Space
Administration

April 1984
Vol. 15, No. 4



About the Cover

April 8 marks the 20th anniversary of the first flight in Project Gemini. GT-1, an unmanned Gemini spacecraft, was a test of the Titan II launch vehicle system, Gemini spacecraft structural integrity and spacecraft-launch vehicle compatibility. After an uninterrupted countdown at Cape Kennedy, the Titan II lifted off at 11 a.m. EST and placed the spacecraft in an orbit of 204 miles in apogee, 99.6 miles in perigee and with a period of 89.27 minutes. All systems functioned well and 132 measurements were taken. The only imperfection in the flight was Titan II's 14-mph excess speed (17,534, instead of 17,520 mph), sending the spacecraft 21 miles higher than planned. This was within tolerance, however, and, on manned flights, crewmen could easily correct the extra height. The 7,000-pound spacecraft was not equipped to separate from the spent rocket casing. The orbiting assembly reentered the earth's atmosphere on April 12, 1964.

Contents

Enterprise Goes to the World's Fair in Unusual Way 3
Delta Launch Ends an Era 4
NASA and Italian Space Agency Sign Two Agreements 5
NASA Special Publications Issued 5
Box-Camera Principle to Decipher Solar Secrets ... 6
Tomato Seeds Carried on Mission 41-C 7
Abrahamson Leaves NASA to Head New DOD Directorate 8
What's New in NASA Television and Radio 8
Sounding Rocket Payload Scheduled for Shuttle Flight 9
Hybrid Craft Joins Kennedy Patrol 9
Canadian Payload Specialists Named 11
Plasma Physics Experiments Conducts from Wallops 11
Patents for Inventions from NASA Research 12
Awards Corner 14
1984 Launch Activity 15
Another Dividend from Air and Space 16

NASA Activities is published monthly by the National Aeronautics and Space Administration for the information of the agency's employees. Contributions and recommendations are solicited from headquarters and field centers, and should be addressed to Editor, NASA Activities, News and Information Branch, Code LFD-2, Washington, D.C. 20546. Material submitted for publication cannot be returned.

Distributed free of charge only to current agency employees. Available by subscription via the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Check or money order should be made payable to Superintendent of Documents, GPO. Subscription rates are $20.00/year domestic; $25.00/year, foreign.

Barbara Selby
Code LFD-2
NASA Headquarters, FOB 6
Washington, D.C. 20546
Phone: (202) 453-8400

Enterprise Goes to the World's Fair In Unusual Way

The Space Shuttle orbiter Enterprise earned its "sea legs" during a land, sea and air move from the West Coast to the Louisiana World Exposition in late March and early April.

The final leg of the 2,300-mile trip was by a barge from Mobile, Ala., to the world's fair site on the New Orleans waterfront.

The 150,000-pound orbiter test vehicle will be displayed at the fair from May 12 through Nov. 11.

The barge trip from Mobile was the only viable method of transporting the DC-9 size orbiter to the New Orleans waterfront. It is too large to transport by rail or road and particularly through the streets of New Orleans to the fair location.

The unusual constraints of the move allowed NASA to test techniques and train personnel on methods for safely handling a Space Shuttle orbiter at sites other than Shuttle launch and landing facilities at Kennedy Space Center, Fla., Edwards Air Force Base and Vandenberg Air Force Base, Calif.

Permanent structures are normally used for mating and demating the orbiter from the Shuttle Carrier Aircraft, a modified 747. If an orbiter ever has to land at a contingency landing site, methods of handling and moving perfected and documented on this trip will be invaluable.

The Enterprise, atop the Shuttle Carrier Aircraft, began its trip to the fair when it flew from Edwards Air Force Base, Calif., to Vandenberg Air Force Base, Calif., for several days of fit-and-function checks. Space Shuttle launches from the Vandenberg site are scheduled to begin in late 1985.

The 747/Enterprise then flew from Vandenberg to Mobile, Ala., with stops along the way at Kelly Air Force Base in Texas, and Little Rock Air Force Base, near Jacksonville, Ark.

At Mobile's Brookley Field, two large transportable cranes and other special ground support equipment detched the orbiter from the 747 and positioned it on a 90-wheel transport trailer.

From the airfield Enterprise was moved to nearby Mobile-Brookley Coast Guard Station and loaded aboard a large ocean barge for the water leg of the trip.

Towed from Mobile through Mississippi Sound, then south through Chandeleur Sound, the barge entered the Mississippi River near Venice, La., and proceeded upriver to New Orleans. The barge trip took three days.

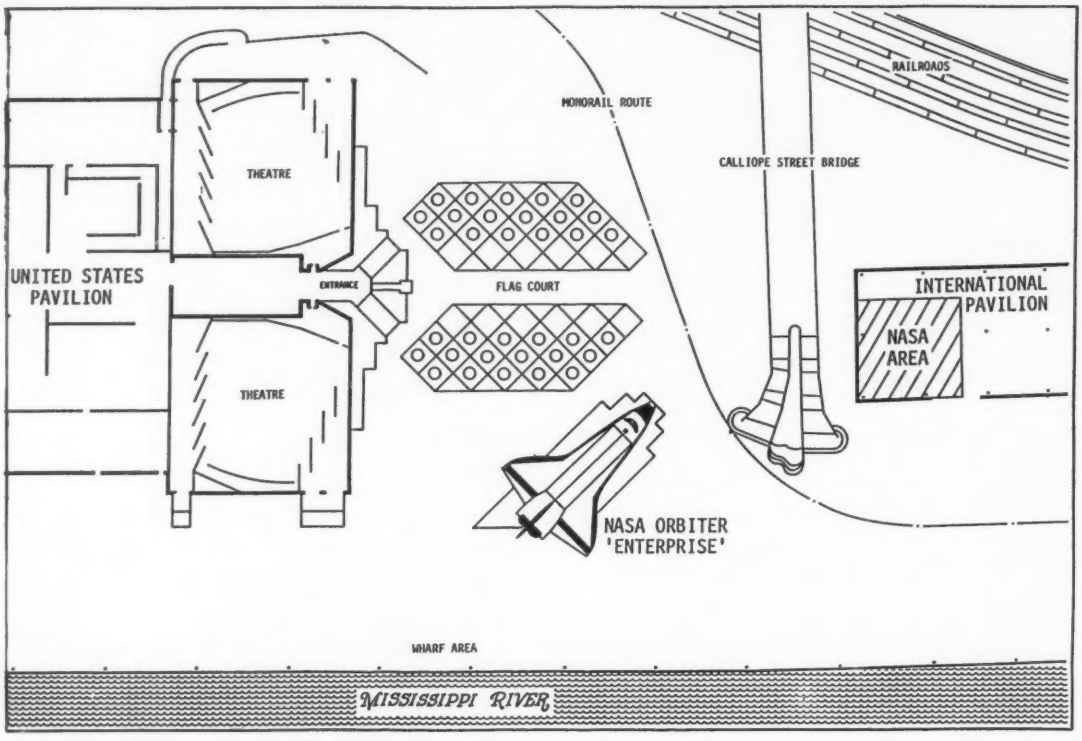
Upon arrival at the Louisiana World Exposition site on the New Orleans waterfront, the Enterprise on its transporter trailer was off-loaded and towed to a location in front of the U.S. Pavilion. Cranes and ground support equipment then removed the Enterprise from the transporter and placed the 122-foot-long vehicle on its display location.

The Shuttle Carrier Aircraft has transported orbiter vehicles since 1977 when Enterprise was first used for unpowered atmospheric test flights. Shuttle orbiters Enterprise, Columbia, Challenger and Discovery have all been ferried from the West Coast to the Kennedy Space Center by the modified 747.

In 1983 the Enterprise was flown to Europe where is was displayed at the Paris Air Show and in other major European cities.

At the conclusion of the Louisiana World Exposition the Enterprise will be ferried back to Vandenberg AFB where is will be used for additional fit-and-function checks at the West Coast Shuttle launch facility.

Enterprise, on the back of the 747 Shuttle Carrier Aircraft, flew over over New Orleans at a mere 2,000 feet, on its way to Mobile. In Mobile, Enterprise was placed on a barge and towed to the Fair site on the New Orleans waterfront.



Location of the Enterprise at Louisiana World Exposition.

Delta Launch Ends An Era

When Delta 174/Landsat 5 was launched from Space Launch complex 2 West at Vandenberg Air Force Base on March 1, it marked the end of two closely related eras. The prime payload aboard was Landsat 5, the final spacecraft in that revolutionary earth resources observation series.

For Kennedy Space Center's Expendable Launch Directorate, the launch of Delta 174 was the final pearl in an 18-year, 39-mission string of successes from the west coast site. The mission also marked the 40th straight success for the workhorse Delta.

An hour after its 9:59 a.m. PST liftoff, with the Delta second stage passing to the west of the island of Madagascar, a 13-second reignition of that stage circularized the polar orbit at an altitude of 440 miles. Minutes later, the two-ton Landsat spacecraft was separated, followed by the 133-pound UOSAT-B, a "hitchhiker" payload. UOSAT-B is an amateur radio and scientific research satellite designed and built by Britain's University of Surrey.

Delta launches from NASA facilities near Purisma Point on Vandenberg began with the Delta 41/ESSA-3 weather satellite mission in October 1966. They have continued at the rate of one or two each year since that time.

"We obviously hate to see launch activities at that pad end," commented Charles D. Gay, expendable vehicles director. "It's been a highly successful and rewarding program conducted by a highly motivated team—and we're pleased that our last shot from SLC-2W was a success.

"We've conducted six Delta launches from Vandenberg in the past three years using the KSC team rotated out here on temporary duty. Now we plan to finish the Delta program at KSC with the same degree of success and professional pride as we saw with the Delta program on the west coast."

NASA's Delta program currently has five remaining missions set, three in 1984, and the final two in the summer of 1986.

NASA and Italian Space Agency Sign Two Agreements

James M. Beggs, NASA Administrator, and Professor Ernesto Quagliarello, President of the Italian National Research Council of Italy (CNR), signed two Memoranda of Understanding (MOU) in Rome last month. The two separate agreements establish the development of the Tethered Satellite System and the development and launch of the Laser Geodynamics Satellite-2 (Lageos-2).

The Tethered Satellite System (TSS) is a data-gathering satellite that will be carried into orbit by the Space Shuttle and released from the payload bay on a tether. It will provide an important new reusable, multidisciplinary facility for conducting space experiments in earth orbit, and will open the way to several areas of long-term scientific experimentation not otherwise possible.

The system will consist of a deployer mounted in the payload bay of the Space Shuttle orbiter to deploy and retrieve a tethered satellite (weight approximately 500 kg) upward or downward from the orbiter at distances up to 100 km.

NASA will develop the TSS deployer, perform the system-level engineering and integration and launch TSS on the Shuttle. CNR will develop the two-module (science and service) TSS satellite and provide system-level support to NASA for technical aspects of the satellite.

NASA and CNR will jointly plan and implement the initial tethered satellite mission to verify system engineering and conduct electrodynamic scientific investigations. The initial mission will be flown in late 1987 to verify controlled deployment, operation and retrieval of the tethered satellite, and to investigate interaction of the satellite with space plasma.

Eleven countries, in 20 locations, are conducting laser ranging activities with the passive Laser Geodynamics Satellite-1 (Lageos-1) launched by NASA in 1976. The agreement that was signed by NASA and CNR outlines the terms for the development of Lageos-2 which will significantly enhance study and understanding of the solid earth and its dynamic processes.

Lageos-2 will be identical in configuration to Lageos-1 and will be placed in an orbit of similar altitude but with a different inclination (51-53 degrees prograde instead of 70 degrees retrograde).

Lageos-2 will also be a spherical satellite with a diameter of 60 centimeters and weighing approximately 411 kilograms and will be launched by the Space Shuttle.

Lageos-2 will contribute to the study of plate tectonics and to the study of the accumulation of crustal strain in areas of high seismicity through very accurate measurements of baseline changes resulting from crustal motion. The two satellites, in essentially opposite orbits, will improve the precision of current laser determined baselines by a factor of two and will make possible achievements of a precision of 1 centimeter for baselines of several thousand kilometers.

These improvements will particularly benefit studies of regional crustal deformation associated with the occurrence of earthquakes in the Mediterranean area being undertaken by the United States and a consortium of European countries. Similarly, studies of the San Andreas Fault System will benefit from Lageos-2 and from the Mediterranean studies.

CNR is responsible for the fabrication of the Lageos-2 satellite, integration of the apogee stage and the Italian Research Interim Stage and delivery to NASA. NASA will provide existing ground support equipment, hardware and software remaining from the Lageos-1 mission, technical consultation and launch on the Space Shuttle as a payload of opportunity with a planned launch in 1987.

NASA Special Publications Issued

Fuel Economy in Aviation, NASA SP-462, has been published by the Headquarters Scientific and Technical Information Branch. The publication is an account of the origins and successes of the nation's Aircraft Energy Efficiency (ACEE) program authorized by the U.S. Congress in 1975, and carried out by NASA.

The author is Jeffrey L. Ethell, an aviation writer, and the book has a forward by William S. Aiken, Jr., Director of the Aeronautical Systems Division.

Copies may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 for $15.

Stellar Atmospheric Structural Patterns, NASA SP–471, is the fourth volume in the NASA/National Center for Scientific Research in Paris, France, monograph series, "Nonthermal Phenomena in Stellar Atmospheres.

Authored by Richard N. Thomas, of the CNRS, the volume summarizes current theories of stellar atmospheric structure and then offers empirically based "patterns" of stellar-atmospheric structure as a basis for substantially improving existing theory.

Copies may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

Box-Camera Principle to Decipher Solar Secrets

NASA's Marshall Space Flight Center, Huntsville, Ala., recently finished a conceptual study of an orbiting facility that would examine the sun by using, in part, the principle of an old-fashioned box camera.

The Pinhole/Occulter Facility derives its name from its functions. It studies the sun with a plate filled with thousands of microscopic holes—a method Marshall study manager Joe Dabbs describes as "a high-tech approach to a child's cardboard pinhole camera." The facility uses a mask that obscures, or "occults," the bright disk of the sun so that its fiery corona can be observed closely. "In effect, it creates an artificial solar eclipse," said Dabbs.

The Pinhole/Occulter would be an element of the Advanced Solar Observatory, a combination of instruments on an unmanned orbiting platform—possibly flying in formation with the Space Station—that would study the full spectral range of electromagnetic radiation from the sun. The Advanced Solar Observatory could fly in the mid-1990s.

"But we hope to fly the Pinhole/Occulter itself before that," said Dabbs. "The facility might be part of the advanced observatory, but it still would have an integral identity of its own. If we can make it part of the Spacelab mission series aboard the Space Shuttle, we could have the facility in orbit in the early 1990s. The year 1992 would be especially timely, because that will be the peak of the 11-year solar cycle."

The facility would consist of a small platform called a "detector plane," containing an array of X-ray dectectors, visible-light and extreme-ultraviolet coronographs and spectrographs. Centered on the platform would be a deployable boom, at the end of which would rest the "occulter plane," a flat, rather square device about six feet across, containing two separate grids of tiny openings, a rounded occulting disk at one corner and a straight occulting edge. The grids and occulting edges would be aligned with their detectors below on the detector plane. The boom would extend about 105 feet.

The X-ray detectors would study the disk of the sun, while the occulters would be used to study the corona.

Like the crude child's box camera, in which a pinhole at the front allows an image to be formed at the rear where film is placed, the Pinhole/Occulter relies upon the same principle—but with dramatic differences. "In the box camera with a single pinhole," Dabbs said, "the image is very faint because of the small amount of light that passes through the hole to the film. You can't make the hole bigger to get a brighter image, because, the larger the hole, the fuzzier the image. So it's better to use lots of small holes."

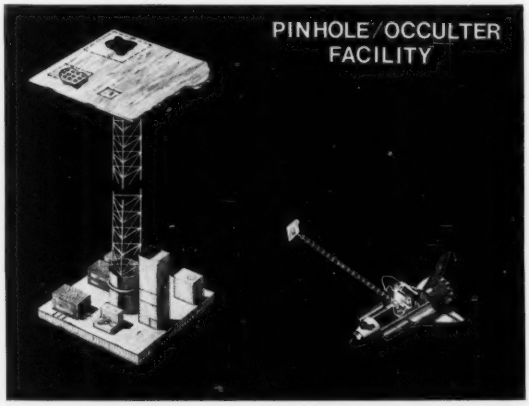
"The same principle applies with the Pinhole/Occulter. The occulter plane has literally thousands of holes which permit a much brighter image of the sun as X-rays pass through the detectors below.

"But there's an important difference in results between a box camera and the Pinhole/Occulter, which has many tiny pinholes for brightness. If you were to punch a considerable number of holes through the front of your box camera, you'd get nothing but a lot of confusing images cast by all those pinholes on the film. The Pinhole/Occulter, however, would have an image proportional counter—a computer that would know how to decipher all those images into a single bright one."

Brightness is required to obtain the full dynamic range of solar intensities. A faint image would only permit the study of relatively bright, active regions and solar flares.

Although many studies of the sun have been accomplished over the years, especially during the Skylab missions of the early 1970s, the Pinhole/Occulter would provide a next generation opportunity. "The solar observations made by Skylab were outstanding," said Dabbs, "but technology continues to advance. The difference between the Skylab solar observations and those that would be possible with the Pinhole/Occulter would be about a factor of 10 in sensitivity and spatial resolution. This difference would apply across the board—X-ray detection and visible-light and ultraviolet coronographs. Skylab effectively was working with one-inch optics, while the Pinhole/Occulter would have 14-inch optics."

These finer optics would allow a higher time resolution, that is, an ability to record events from moment to moment rather than over long durations. Furthermore, the optics would enable observers to look much more closely at the sun, to see the lower corona



and surface of the sun more clearly than is currently possible.

The facility promises to reveal answers to many mysteries of the sun, such as how flares develop; how the corona of the sun is heated to temperatures 20 times hotter than its surface; and exactly where and how the corona is acclerated to form the solar wind, which blows throughout our solar system.

"The complexity of the sun demands a facility like the Pinhole/Occulter to unravel these mysteries," said Dabbs. "But when you realize that the facility has its foundations in a number of simple principles, it raises an interesting question: "Who would have guessed that the principle behind a child's box camera might someday help unlock the secrets of the sun?"

Tomato Seeds Carried on Mission 41-C

NASA's Project SEEDS carried 12.5 million tomato seeds on Space Shuttle Mission 41-C.

The SEEDS (Space Exposed Experiment Developed for Students) project is a cooperative experiment involving the NASA Headquarters Education Services Branch, the Park Seed Co. of Greenwood, S.C., and NASA's Langley Research Center, Hampton, Va.

Provided by Park Seed Co., the 12.5 million tomato seeds were placed in five sealed aluminum canisters. Passive detectors were placed in the canisters to record the highest temperature experienced in flight and to measure space radiation accumulated throughout the exposure period.

NASA's primary objectives in the SEEDS experiment are: to involve a large number of students in a national project generating interest in science and related disciplines; to offer students from upper elementary through university levels an opportunity for a first hand experience with materials flown in space; to emphasize an interdisciplinary approach to the project; and to provide opportunity for sharing results.

The SEEDS project has the potential to involve directly approximately 4 million students in 250,000 classrooms in a research effort. NASA envisions this program going far beyond the technical aspects of planting seeds and making observations on their growth and development. Benefitting from their instructors' guidance and expertise, students can apply academic skills learned in the classroom to a real research problem.

The NASA vehicle for these pioneer space experiments is the Long Duration Exposure Facility (LDEF). This is a large, unmanned facility which inexpensively accommodates technology, science and applications experiments requiring a freeflying exposure in space. After approximately 12 months exposure to the space environment the LDEF will be retrieved by another Shuttle flight and returned to earth.

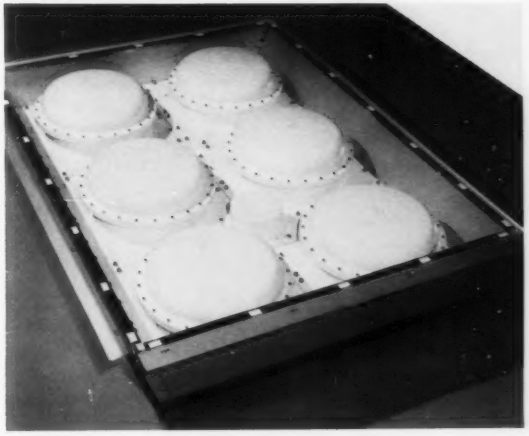
The flight seeds will be returned to the Park Seed Co. where an equal number of control seeds from the same lot will be maintained in a ground-based facility for the duration of the 41-C mission.

Following appropriate analysis, Park Seed staffers will package both flight seeds and control seeds with instructional materials, developed by the NASA Education Services Branch, containing information on at least one NASA-prescribed experiment.

The kits will be distributed by NASA Headquarters to classrooms nationwide from grade 5 through the university levels at the beginning of the 1985 fall semester.

This project presents a variety of experiment possibilities for four educational levels. Upper elementary and secondary levels 7 to 9 can compare germination rates and times, seed embryos, phototropic responses and fruit products. Students can also consider the impact of changes in environmental factors. In addition to these experiments, upper secondary and university students could perform chromosome and population genetics studies.

Project SEEDS will allow students to design their own experiments using the seeds and to be involved in decision making and data gathering. This will be the first known opportunity for long-duration exposure of living tissues, so every classroom experiment will be significant.



Tomato seeds carried on Shuttle mission 41-C were placed in sealed aluminum canisters. White paint on the canisters provides thermal protection.

Abrahamson Leaves NASA to Head New DOD Directorate

Lt. Gen. James A. Abrahamson, NASA Associate Administrator for Space Flight, has been named Director of Strategic Defense, reporting directly to the Secretary of Defense. He assumed his new post on April 15.

On assignment from the Air Force, Abrahamson became head of the Space Flight office in November 1981. During his time with NASA, he directed 10 Space Shuttle missions.

Before coming to NASA, Abrahamson had been Deputy Chief of Staff for Systems Command at Andrews Air Force Base, Md. Abrahamson has long been involved in the Air Force and NASA's space programs. In August 1961, he was assigned as spacecraft project officer on the VELA Nuclear Detection Satellite program at Los Angeles Air Force Station, Calif. He attended Aerospace Research Pilot School at Edwards Air Force Base, Calif., and became an Air Force test pilot in 1967. He was selected as an astronaut with the Air Force's Manned Orbiting Laboratory Program and was with the program until its cancellation in June 1969. He served on the staff of the National Aeronautics and Space Council in the Executive Office of the President of the United States. In 1979 he was chosen by NASA for a special team charged with assessing the management of the Space Transportation System.

Jesse W. Moore has been designated Acting Associate Administrator for Space Flight, effective April 15. He has been Abrahamson's Deputy.

Moore came to NASA Headquarters in 1978 as the Deputy Director of the Solar Terrestrial Division in the Office of Space Science. He was the Director of the Spacelab Flight Division until December 1981, at which time he assumed the position of Director of Earth and Planetary Exploration Division in the Office of Space Science and Applications, where he remained until February 1983, when he was appointed to the position of Deputy Associate Administrator for Space Flight.

Prior to these assignments, he was employed at NASA's Jet Propulsion Laboratory in Pasadena, Calif., beginning in 1966 where he worked in a variety of areas, including guidance and control, advanced programs and flight projects. His last assignment at JPL was as the Science and Mission Design Manager for Project Galileo.

What's New in NASA Television and Radio Programming

Programs released in March:

Television

Aeronautics & Space Report
(4½ minutes plus 90-second versions):

Space Shuttle . . . The 11th Flight

Radio

Space Story (4½-minute programs):
Solar System Exploration (featuring Dr. Geoffrey Briggs, NASA Headquarters)
Spacelab 1 (featuring Dr. Rick Chappell, Marshall Space Flight Center)
Stall Spin Research (featuring Jim Patton, Langley Research Center)
Seasat (featuring Tim Dixon, Jet Propulsion Laboratory)

Special Report (14½-minute program):

Spacelab 1 (featuring Dr. Rick Chappel, Marshall Space Flight Center)

Copies of television tapes are sent simultaneously to all NASA Visitor Information Centers and Public Affairs Offices, and to 650 television stations nationwide as well as to 425 cable television systems via the satellite RCA-Cablenet 1. Five hundred television stations receive material formatted as a 4½-minute program; the remaining 150 stations receive a 90-second "spot"—a condensed version of the 4½-minute presentation.

NASA's radio programs are sent to approximately 3,500 radio stations across the nation; in addition, translations of the recordings are made by Voice of America and Radio Free Europe and these tapes are then released to the appropriate audiences overseas. Released each month are one report of 14½ minutes and four 4½-minute weekly stories (one story in the set is featured for one week of the month). Ten one-minute space notes are released quarterly.

Sounding Rocket Payload Scheduled for Shuttle Flight

Spartan 1, a carrier for sounding rocket experiments to be flown and deployed by a Space Shuttle, will have its first test in August on mission 41-F aboard orbiter Discovery. The payload is being developed by the Special Payloads Division at Goddard Space Flight Center, Greenbelt, Md.

The first Spartan payload will carry an X-ray experiment from the Naval Research Laboratory. Discovery will use its robot arm to deploy the 2,200-pound box-like structure and leave it to operate autonomously for more than 40 hours. Discovery will travel at least 80 miles from the payload during the first half of Spartan 1's operations, and return slowly during the second half. The payload then will be retrieved and stowed in the cargo bay, powered down for the remainder of the mission and returned to earth.

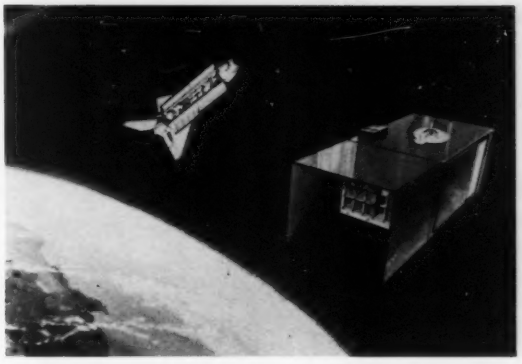
The Spartan project began in 1979 with a major objective to devise a means for Shuttle-borne sounding rocket experiments. Project officials expect to augment existing sounding rocket operations with longer data acquisition times offered by the Shuttle. At the same time, they expect to continue the high rate of success typical of current sounding rockets by using existing methods and hardware where possible.

According to project officials at Goddard, the Spartan operational concept is to use the Shuttle and her crew's resources as little as possible. This will allow maximum flight opportunities and quick release time, according to project manager Dave Shrewsberry.

Plans call for the crew to employ the Autonomous Payload Command System (APCS) to communicate with Spartan while in the cargo bay. Upon release of Spartan, its onboard timers will begin. All operations will be pre-programmed based on deployment time. When the data gathering is finished, the spacecraft will stabilize itself and await pickup by the Shuttle. Recovery is essential because all data will be stored in a tape recorder onboard the spacecraft, eliminating communications between the orbiter and the payload. Relative position of the two spacecraft will be determined by ground-based radars.

Success of Spartan 1 is expected to encourage the flight of more Shuttle-borne sounding rocket instruments as a low-cost approach for scientific exploration of space. Work has already begun on Spartans 2 and 3, according to Shrewsberry.

"We plan to phase out fine-pointing sounding rockets by 1990," Shrewsberry said. "Spartan 1's success should prove that sounding rocketry can be merged into STS operations without taxing complications.



An artist's concept of Spartan 1.

Hybrid Craft Joins Kennedy Patrol

The boat skims the water at nearly 50 miles per hour. Suddenly, just ahead of the bow, the water changes from the dark gray-green of the channel to the yellow-white that means water only inches deep. But instead of the splintering crash that might be expected, the boat roars across the oyster bar unharmed and unslowed.

The ability to operate in water only inches deep is the chief attribute of that cross between an airplane and a flat bottomed boat, the airboat. The Kennedy Space Center Patrol is now in the position of making best use of that ability, having recently acquired a 16-foot, aluminum hulled airboat for use in patrol duties.

Because many thousands of acres at KSC are composed of marshlands, swamps and other shallow water areas, routine patrol in those areas has been extremely difficult or impossible. Regular boats cannot be maneuvered in that kind of territory without endangering the craft or the officers. The result is that large areas of Kennedy have been inaccessible to ground security forces.

According to Ken Lopez, the the KSC Security Office, the solution to the problem is the airboat, which is powered by a modified 275 horsepower automobile engine and a "pusher" type aircraft propeller. The smooth, flat bottom of the airboat hull can slide over water only an inch or two deep, and can even be driven across mud and vegetation for short distances when necessary.

Head of the airboat program, EG&G Security Officer Sgt. Perry Thomas said that the airboat is intended for regular patrol of the Launch Complex 39 area and will normally be operated in open water areas. "We will be running in the edges and shallows most of the time," he

Sgt. Perry Thomas pilots KSC's newest patrol vehicle across the shallow waters south of the Space Shuttle launch pad. Below, spray flies behind the airboat during a pilot's final examination run.

said, "in order to protect the wildlife back in the marshes. But we have the ability to go almost anywhere back there if we have to."

The patrol is now in the process of training a small cadre of airboat pilots, under the tutelage of Sgt. Thomas.

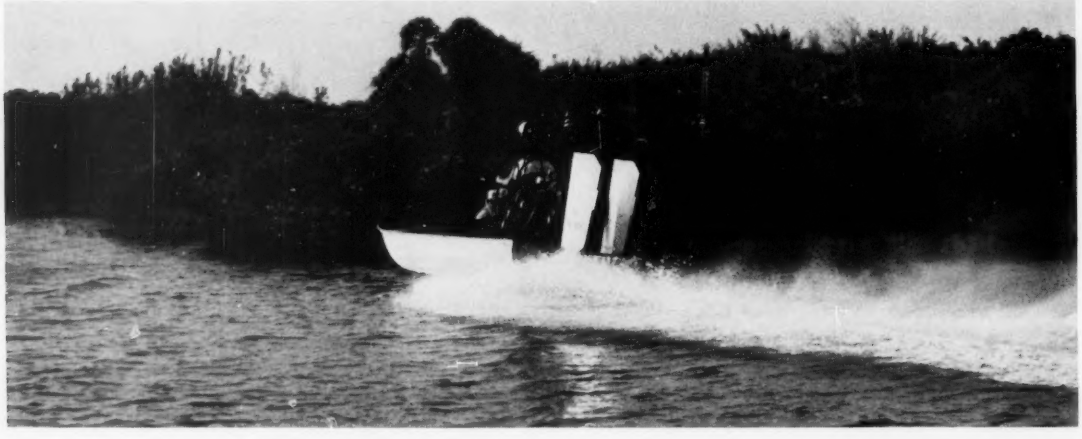
"An airboat can be a very tricky craft to operate, so we are requiring a very stringent training and testing program," said Sgt. Thomas. "Besides meeting all the regular state and federal safety requirements for this type craft, we have adopted more extensive rules. We even borrowed some operating standards from the Federal Aviation Administration because an airboat shares many of the safety problems of aircraft."

After classroom training, but before officers can serve as fully qualified airboat pilots, they must pass rigorous written, oral and practical examinations of their skills. Testing and certification of vehicle operators is performed by EG&G's Heavy Equipment Section. Licensing examiner for the KSC program is EG&G's Richard Lowman, an airboat operator with over 20 years experience.

Wearing a radio-equipped helmet, flotation vest and other safety gear, each potential airboat pilot must navigate a winding, obstacle-ridden path through the channels and spoil islands south of Pad 39A as the practical portion of his or her operator's test, all under the critical eye of licensing examiner Lowman.

At some point during the high-speed run, Lowman might throw up both arms, a signal which calls for the pilot to make an emergency stop. At other times, he may point abruptly to one side, directing a sharp avoidance turn. In choppy waters, and especially with a crosswind, such a stop or turn can be a skidding, heartstopping maneuver. Each operator must be capable of handling such an emergency as well as events of less urgency such as mechanical problems.

"This airboat promises to vastly expand our abilities to patrol and protect the Center," said Sgt. Thomas. "With a normal crew of two to four officers, the airboat's capabilities will be a real boon to our efforts and will also allow us to more carefully monitor our wildlife environment. It's a definite asset."



Canadian Payload Specialists Named

The Canadian crew member and back-up crew member for an October 1984 Space Shuttle mission have been announced by Canadian Minister of State for Science and Technology and for Economic and Regional Development, Donald J. Johnson.

Commander Marc Garneau, Canadian Department of National Defense, Ottawa, has been named the flight crew member. His back-up is Dr. Robert Thirsk of Montreal. Garneau and Thirsk were chosen from the six-member Canadian space team selected in December 1983.

The Payload Specialists will undergo approximately four months training at NASA facilities prior to the 51-A Shuttle mission.

Plasma Physics Experiments Conducted from Wallops

A series of three rockets were launched Feb. 23 to obtain measurements of the atmosphere's electric field and of the ion density and conductivity.

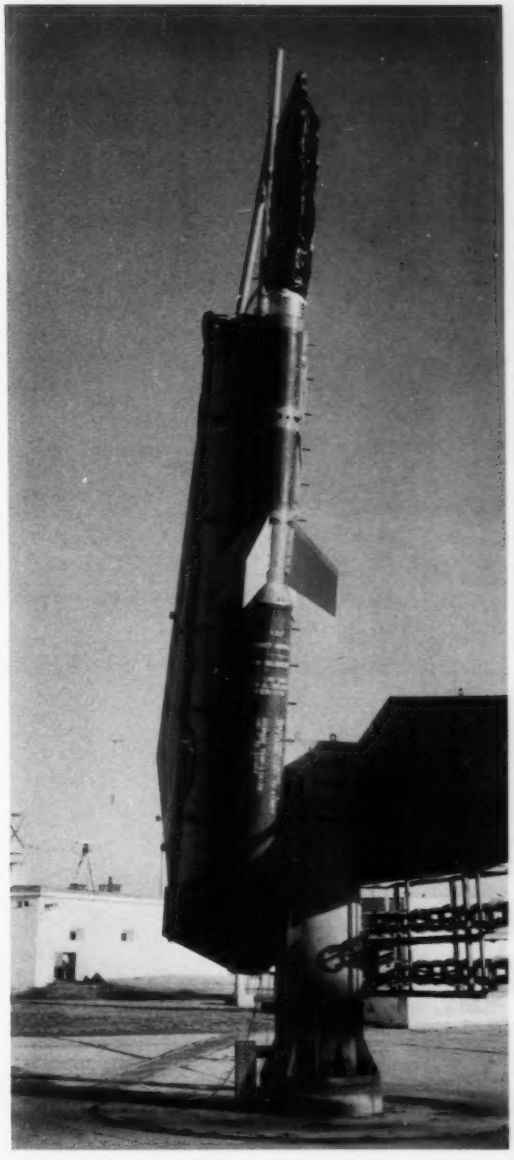
Each of the rocket vehicles carried instruments to measure the electric fields in the middle atmosphere, the region between approximately 20 and 100 kilometers (about 12-62 miles). Two of the rockets also carried instruments to measure conductivity. Such measurements will help develop our understanding of the coupling between the electrical environment, the ionosphere and the lower atmosphere electrification which is related to thunderstorms. Detailed electric field measurements within the earth's middle atmosphere are just beginning to be made through programs of this type, and scientists consider them essential to increase our knowledge about interactions between various parts of the atmosphere.

A secondary objective is to compare the various measurement techniques commonly used to obtain this kind of information.

The vehicles used for the experiments were the Super-Arcas, 10 feet long, 4½ inches in diameter; the Viper Dart, 14 feet long, 4½ inches in diameter; and the Nike-Orion, a two-stage rocket vehicle about 30 feet (8 meters) long and 17 inches in diameter.

Similar experiments were conducted from the Wallops range last fall during the pre-dawn hours. Data obtained from the current post-dawn flights will be correlated with the previous pre-dawn measurements.

Dr. Nelson C. Maynard of NASA's Goddard Space Flight Center in Greenbelt, Md., is the project scientist for the Viper-Dart and the Nike-Orion mission and Dr. Leslie C. Hale, Penn State University, University Park, Pa., is the project scientist for the Super Arcas experiment. The Wallops payload managers are Geoffrey Bland, Dave Kotsifakis, and Dave Moltedo. Wallops project engineers are Robert Frostrom and Debbie Messamore.



Two-stage Nike-Orion.

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces the following U.S. patents have been issued by the U.S. Patent Office and Trademark Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) & Employer	Title	Patent No.	Installation
Raymond J. Stattel, James. K. Niswander, NASA/GSFC	Memory-based parallel data output controller	4,435,781	GSFC
George W. Kurtz, Ben F. Barkston, NASA/MSFC	Two-dimensional scanner apparatus	4,434,659	MSFC
Marcia M. Neugenbauer, Douglas R. Clay, Bruce E. Goldstein, Raymond Goldstein, Caltech/JPL, Pasadena, Calif.	Ion mass spectrometer	4,435,642	NRO-JPL
Leonard L. Kleinberg, NASA/GSFC	Low noise tuned amplifier	4,437,069	GSFC
William J. Waters, NASA/LeRC	Multicolor printing plate joining	4,437,923	LeRC
Bruce A. Banks, NASA/LeRC	Diamondlike flake composites	4,437,962	LeRC
Donald E. Routh, Gian C. Sharma, Gian Sharma DBA, Sharma & Associates, Huntsville, Ala.	Method for sequentially processing a multi-level interconnect circuit in a vacuum chamber	4,437,961	MSFC
Margaret A. Reid, Robert E. Post, Daniel G. Soltis, NASA/LeRC	Method of making a light weight battery plaque	4,439,465	LeRC
Herbert S. Kobayashi, Paul W. Shores, Patrick Rozas, NASA/JSC	Doppler radar having phase modulation of both transmitted and reflected return signals	4,439,766	JSC
Frank J. Nola, NASA/MSFC	Motor power control circuit for A.C. induction motors	4,439,718	MSFC
Benjamin Reichman, Charles E. Byvik, Christopher Newport College, Newport News, Va.	Chalcogenophosphate photoelectrodes	4,439,301	LaRC

Contractor News

NASA has selected **McDonnell Douglas Astronautics Co.,** Huntington Beach, Calif., and **TRW, Inc., Technology Group,** Redondo Beach, Calif., for negotiations that will lead on two parallel Space Station study contracts.

Each contract is for a firm fixed-price of approximately $2 million, for a period of about 27 months beginning in March.

The contracts are for the development of functional, performance and technology requirements; the definition of system architecture for the Space Station Data System; and the relationship of that system to the overall NASA end-to-end flight and ground information system. The studies will define the role of the Space Station Data System and its relationships and interfaces to the Space Station Information System elements. The relationship of the Space Information System and the overall NASA end-to-end data system will be analyzed.

The studies also will define the data system to determine the environment in which both user and facility subsystems interface and operate. They will address all avionics and other electronically automated Space Station functions; develop a clear understanding of system functional, operational and interface requirements; identify major cost items to enable effective management decisions and development control; and define a program plan.

Goddard Space Flight Center's, Wallops Flight Facility, Wallops Island, Va., has awarded a contract the **University Corporation for Atmospheric Research,** Boulder, Colo., for operation and

maintenance of the National Scientific Balloon Facility in Palestine, Texas. The $7,076,741 cost-plus-fixed-fee contract, effective April 1, 1984, is for a basic and two one-year option periods. The contractor will provide the personnel, materials, supplies and services to manage, operate and maintain the facility, to include flight program operation, engineering activities and research and development. Sixty to 70 scientific balloon flights a year are conducted from the facility.

Kennedy Space Center, Fla., has awarded **Boeing Services International, Inc.,** a $2,794,895 contract extension to provide support for Space Shuttle cargo operations. Boeing will continue to provide technician support to aid in the installation and checkout of payloads being installed in the Shuttle orbiter while it is in a horizontal position at the Orbiter Processing Facility, including all Spacelab payloads. The company is also responsible for any modifications made to the racks and pallets on which Spacelab experiments are loaded before being placed in the orbiter, and for maintenance and modifications made to ground support equipment for the experiments.

The cost-plus-fixed-fee contract extension, for the period April 1, 1984, through Sept. 30, 1985, brings the total value of the contract to $4,840,973.

Lewis Research Center, Cleveland, Ohio, has awarded the following contracts:

- A $1.5 million contract has been awarded to **Mechanical Technology, Inc.,** of Latham, N.Y., to design and build a 25-kilowatt Stirling engine power module. This module will be used to demonstrate feasibility issues such as power scaling, high efficiency, dynamic balancing, lightweight components and non-contacting gas bearings.

Under the contract, MTI will build and test a Space Power Demonstrator Engine, a totally sealed module consisting of a free-piston Stirling engine directly coupled to a linear alternator.

Invented by the Rev. Robert Stirling in 1816, the Stirling engine never gained considerable commercial success, due to its bulk, giving way to such later developments as the electric motor and the internal combustion engine. However, its high efficiency coupled with materials advances and its potential for long life and high reliability makes the technology desirable for space application.

The feasibility demonstration to be conducted by MTI is part of an interagency cooperative effort by NASA, Defense Advanced Research Agency of the Department of Defense and the Department of Energy to develop a nuclear power system capable of producing 100 kilowatts of electrical power for spacecraft of the 1990s and beyond.

- A $1.8 million contract has been awarded to **Ford Aerospace & Communications Corp.** to develop a pre-prototype model of a high-powered, long-lived bipolar nickel-hydrogen battery for future space applications. The research to optimize the battery's components and their performance, and develop the pre-prototype hardware necessary for future engineering and production, will take place over a three-year period at Ford's Western Development Laboratories Division in Palo Alto, Calif. Space platforms of the future will require power systems far beyond those in the 1 kilowatt range now in use in the space industry. The new bipolar nickel-hydrogen battery is believed capable of producing high power levels for applications such as the Space Station.
- **Amdahl Corp.,** Sunnyvale, Calif., has been selected for negotiations expected to lead to the award of a contract for two new computer systems, one to support scientific and engineering computational requirements and the second to expand computer graphics capabilities. Estimated value of the contract is approximately $9.4 million. It is anticipated that a fixed price contract for approximately one half of the total value will be awarded for the initial purchase of the two computer systems, with fixed price options for the balance of the total value for upgrading, maintenance and support of the two systems. The contract period is to be from date of award through Sept. 30, 1984, with followup options for a total contact life of approximately six and one-half years.

Each of the new computer systems will include a processor with a minimum of 8 million bytes of primary memory and the ability to execute at least 3 million instructions per second. Supporting equipment will include tape drive, disk storage, a card reader, printers, terminals and channel-to-channel hardware.

- **Lockheed-Georgia Division of Lockheed Corp.,** Marietta, Ga., has been selected for negotiations expected to lead to the award of a contract for the design, fabrication and ground test of a propfan propulsion system. It includes an option for flight test of the system mounted on the wing of a modified Gulfstream II testbed airplane. Estimated value of the basic contract is approximately $31 million, with the flight test option estimated at $15 million.

Under the Propfan Test Assessment contract, Lockheed-Georgia will verify the blade structural integrity and determine the acoustic characteristics of a large-scale (9-foot diameter) advanced propeller (propfan) being designed and fabricated by the **Hamilton-Standard Division of United Technologies Corp.,** Windsor Locks, Conn., under a separate NASA contract.

Awards Corner

James M. Beggs, NASA Administrator, received Syracuse University's prestigious Salzberg Medallion, presented each year to an outstanding individual in the transportation field. The award was presented by Syracuse Chancellor Melvin A. Eggers on April 5 at ceremonies following the annual Salzberg Lecture, which was given by Beggs.

Edward Polhamus, head of Langley's Fluid Dynamics Branch at the time of his retirement in 1981, recently received the AIAA Wright Brothers Lectureship in Aeronautics. The award was accompanied by the Wright Brothers Medal. The honor has been awarded each year since 1937 to "commemorate the first powered flights made by Orville and Wilbur Wright at Kitty Hawk in 1903, and intended to emphasize significant advances in aeronautics by recognizing major leaders and contributors thereto." Polhamus received the medal and presented his lecture, "Applying Slender Wing Benefits to Military Aircraft," during the AIAA/AHS Aircraft Design, Systems and Technology Meeting in Ft. Worth, Texas.

Robert L. Swain, Director of Systems Engineering and Operations at Langley Research Center, Hampton, Va., has been selected as NASA's Engineer of the Year and its nominee in the 1984 Federal Engineer of the Year Awards Program. Swain was recognized for his outstanding leadership and superior engineering capabilities. He was project manager for the construction of the $85 million National Transonic Facility at Langley. The NTF is a unique test facility that provides full-chord Reynolds numbers of 120 million through a cryogenically cooled, pressurized nitrogen gas test medium. No other wind tunnel in the world provides similar capability for aeronautical testing. Swain's leadership was also reflected in his recent chairmanship of NASA's investigation of the December 1982 accident at the 40-by-80-by-120-Foot Wind Tunnel at NASA's Ames Research Center, Mountain View, Calif. Exceptional engineering and management expertise was required to determine the cause of this accident and take appropriate remedial actions.

Dr. John Parker (center), Chief of the Chemical Research Project Office at NASA's Ames Research Center, Mountain View, Calif., received the 1983 GEICO Public Service Award for his contributions in the field of fire prevention and safety. Directed by Parker, his Fire Worthiness Research Team has provided effective modifications on existing aircraft materials and structures that should save lives in in-flight and post-crash fires of domestic transport aircraft. Shown with Parker at the presentation ceremony in Washington, D.C., is William B. Snyder, President of the Government Employees Insurance Co. (left), and Hans Mark, NASA Deputy Administrator.

1984 Launch Activity

Space Shuttle Launches

Date	Mission	Orbiter	Launch Site*	Mission Remarks
Feb. 3	41-B	Challenger	KSC	Payload: SPAS-01A, Palapa B-2, Westar-VI; successful launch
April 6	41-C	Challenger	KSC	Payload: Solar Max Repair Mission; Long Duration Exposure Facility; successful launch.
June 19	41-D	Discovery	KSC	Payload: Syncom IV-1, Large Format Camera, OAST-1; first flight of Discovery
Aug. 9	41-F	Discovery	KSC	Payload: Telstar 3-C, SBS-D, Syncom IV-2, SPARTAN-1
Aug. 30	41-G	Columbia	KSC	Payload: OSTA-3, ERBS, SPARX-1
Sept. 28	41-H	Challenger	KSC	Payload DOD mission or TDRS-B
Oct. 24	51-A	Discovery	KSC	Payload: MLS-1, Telesat-H, GAS Bridge
Nov. 21	51-B	Challenger	KSC	Payload: Spacelab 3
Dec. 17	51-C	Discovery	KSC	Payload: TDRS-B or TDRS-C, MSL-2

Satellite Deployments from the Space Shuttle

Date	Mission	Launch Vehicle	Launch Site*	Mission Remarks
Feb. 3	Westar-VI	PAM-D	41-B	Western Union communications; successful deployment from STS 41-B; satellite failed to achieve geosynchronous orbit
Feb. 6	Palapa B-2	PAM-D	41-B	Indonesia communications; successful deployment from STS 41-B; satellite failed to achieve geosynchronous orbit
June 20	Syncom IV-1	UUS	41-D	Hughes communications
Aug. 9	SBS-D	PAM-D	41-F	Satellite Business Systems commercial communications
Aug. 10	Syncom IV-2	UUS	41-F	Hughes communications
Aug. 11	Telstar 3-C	PAM-D	41-F	AT&T communications
Sept. 28	TDRS-B(?)	IUS	41-H	NASA communications
Oct. 24	Telesat-H	PAM-D	51-A	Canadian communications
Dec. 17	TDRS-B or C	IUS	51-C	NASA communications

Expendable Launches

Date	Mission	Launch Vehicle	Launch Site*	Mission Remarks
March 1	Landsat 5	Delta	WSMC	NOAA earth observation; launch successful
May 17	Intelsat V-G	Atlas Centaur	ESMC	Intelsat international communications
May 24	Galaxy-C	Delta	ESMC	Hughes commercial communications
August	NOAA-F	Atlas-F	WSMC	NOAA weather satellite
August	Intelsat VA-A	Atlas Centaur	ESMC	Intelsat international communications
Aug. 2	AMPTE	Delta	ESMC	Active Magnetospheric Particle Traceer Explorer; space physics—NASA cooperative with Germany
September	NATO-IIID	Delta	ESMC	North Atlantic Treaty Organization communications
November	Intelsat VA-B	Atlas Centaur	ESMC	Intelsat international communications
December	San Marco D/L	Scout	SMR	International cooperative with Italy
4th Qtr.	AF-16 (ITV-1)	Scout	WFF	U.S. Air Force
4th Qtr.	Navy-21	Scout	WSMC	U.S. Navy

***Launch Sites:**
ESMC—Eastern Space and Missile Center, Fla.; KSC—Kennedy Space Center, Fla.; SMR—San Marco Range, Indian Ocean; Space Shuttle Orbiter Challenger: 41-B, 41-C, 41-H, 51-B; Space Shuttle Orbiter Columbia; 41-G; Space Shuttle Orbiter Discovery: 41-D, 41-F, 51-A, 51-C; WFF—Wallops Flight Facility, Wallops Island, Va.; WSMC—Western Space and Missile Center, Vandenberg Air Force Base, Calif.

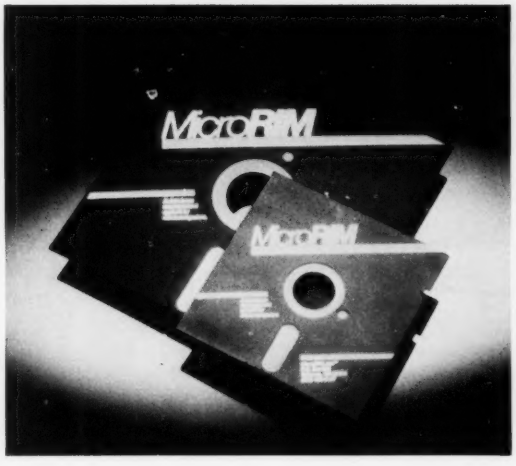
Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

Microcomputer Software

MicroRIM, Inc., Bellevue, Wash., has developed a data base management system for microcomputers that offers, the company says, the sophistication and versatility normally available only in a "mainframe" software package. MicroRIM provides a means to store, sort and retrieve data for a wide variety of business, scientific, educational and government applications. The software allows non-technical personnel to define the data base structure and allows changes in the structure to accommodate new requirements or changing applications. The program is readily convertible to different computers.

MicroRIM is a derivation of a mainframe data base management system called RIM (Relational Information Management) that was developed under NASA funding and used by NASA to store the voluminous data required for analyzing the heat shield tiles on the Space Shuttle orbiter. RIM is used by several hundred major industrial companies and universities. Typical applications include structural analysis, design data management, personal file management, problem tracking, airport data management and subcontractor business reporting/tracking.



* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of its technology.

NASA
National Aeronautics and Space Administration